



# **Armed Forces College of Medicine**

## **AFCM**



# Thymus

## Dr. Hanan A Saleh

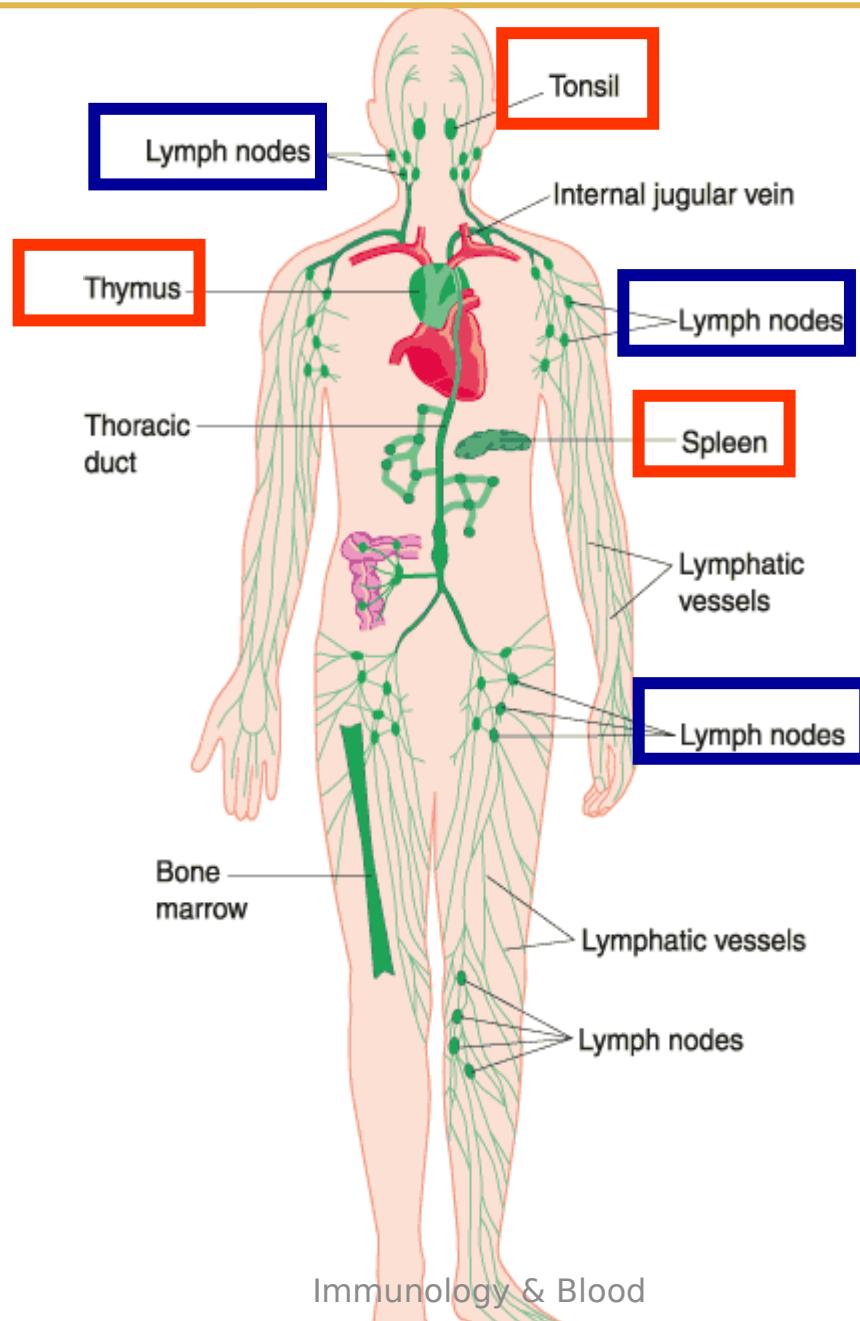
### Professor of Histology



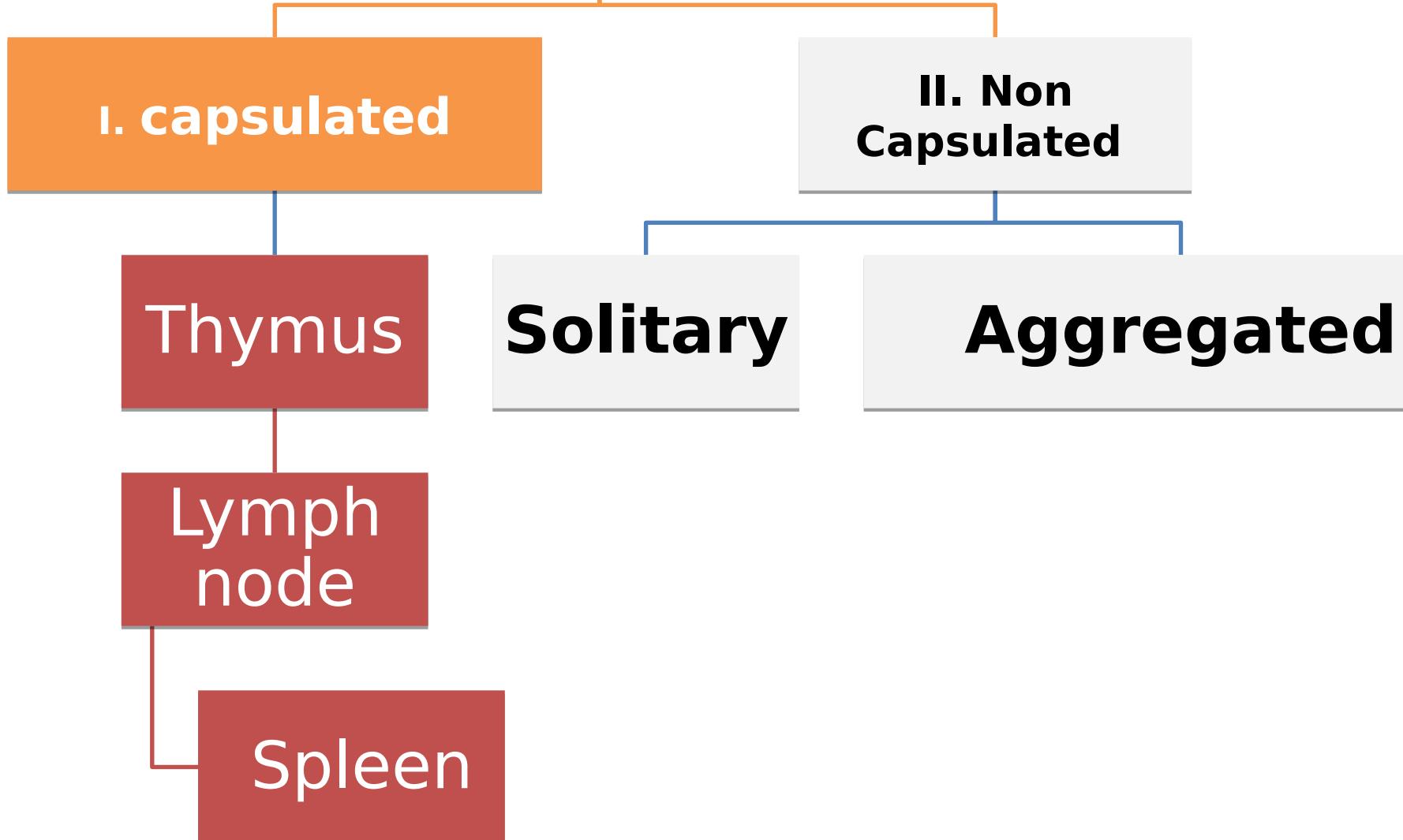
- **By the end of this lecture you should be able to:**

- 1. Describe the microscopic structure of the thymus (**medulla of the thymus**).**
- 2. Correlate the structure of the thymus to the **function**.**
- 3. Correlate the structure to the function of the **blood thymus barrier**.**
- 4. Interpret the defects in structure of**

# The Lymphatic System



# LYMPHOID TISSUE



# The Thymus



- **Bilobed organ.**
- **Large early in life and involutes near the age of puberty.**
- **Is the primary or central lymphoid organ for → T cell education.**
- **Derived from**
  - **- Endoderm (epithelial reticular cells)**
  - **- Mesoderm (lymphocyte)**

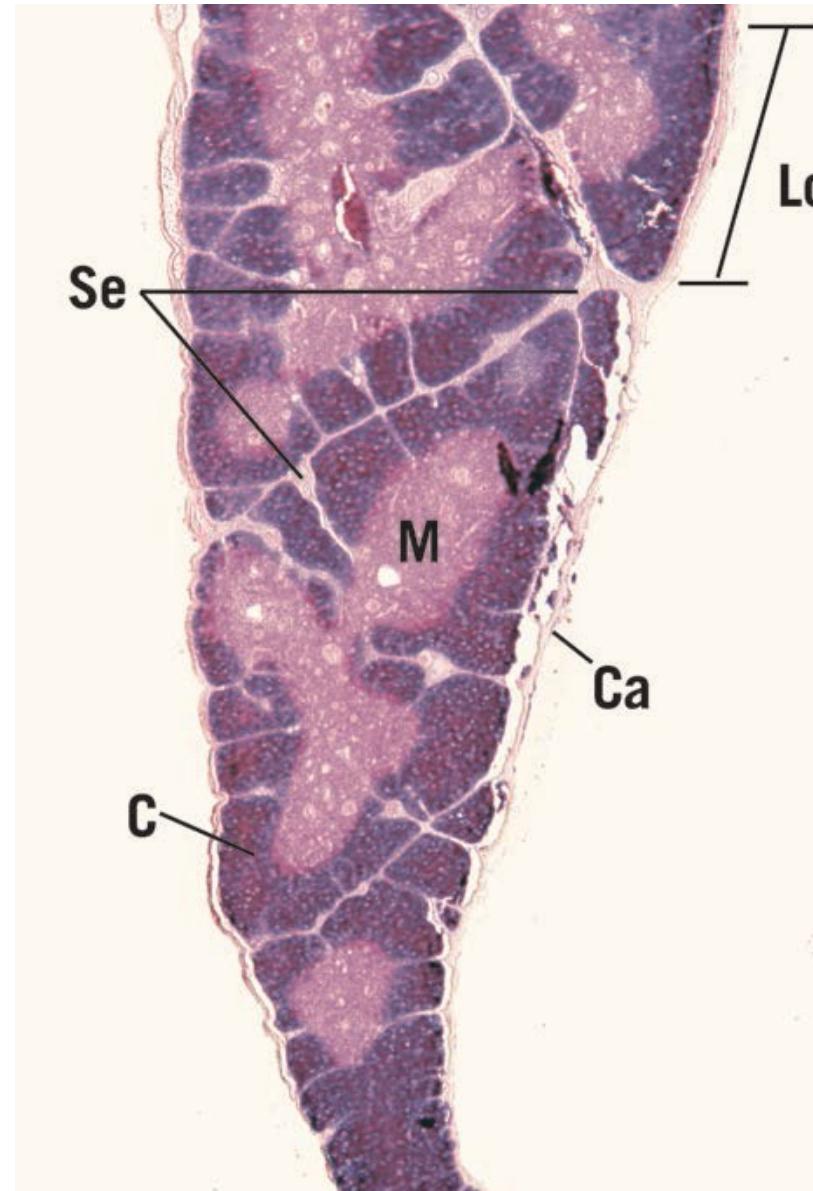


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# The Thymus



- Stroma
- Parenchyma



# The Thymus

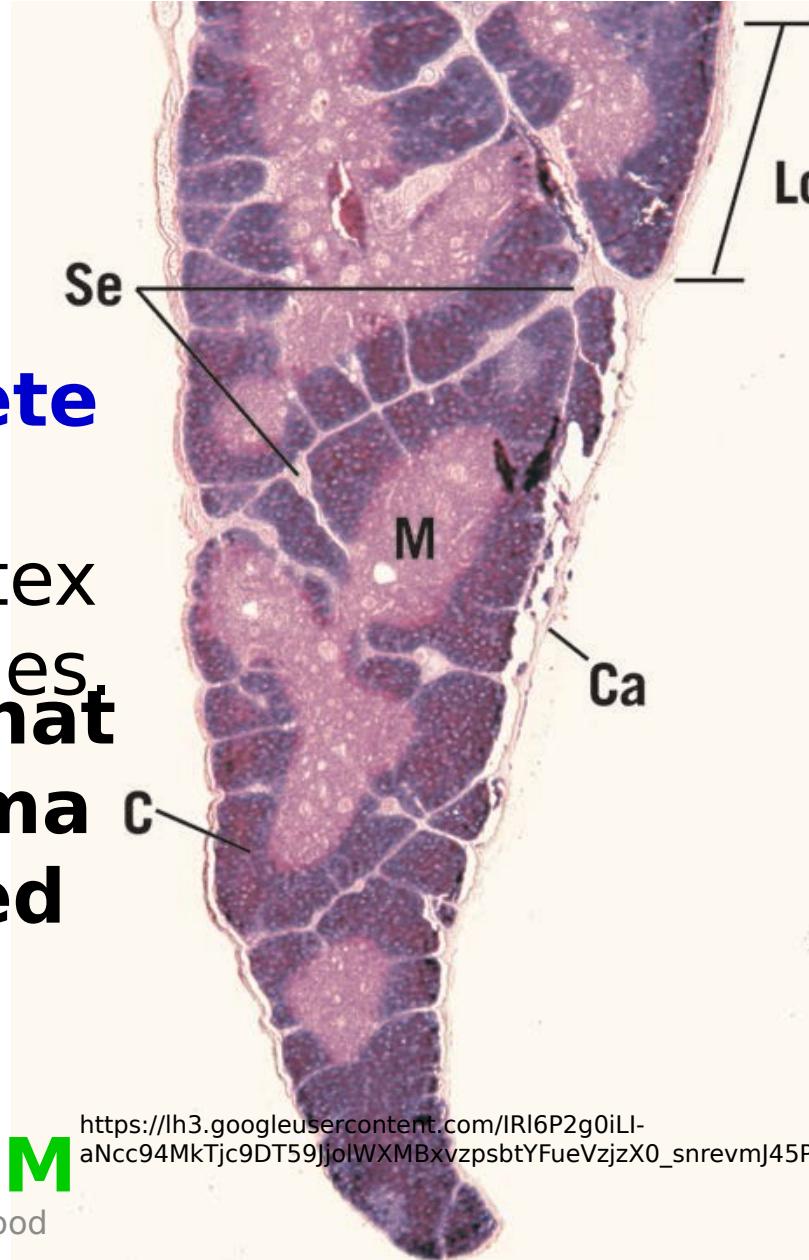


## ■ Stroma

1. **Capsule: thin**
2. **Trabeculae:** divide parenchyma into **incomplete lobules** so that there is continuity between the cortex & medulla of adjacent lobules

**The reticular stroma that support the parenchyma of the thymus is formed by **Epithelial-Reticular Cells (ERCs)****

**CYTORETICULUM**



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# The Thymus

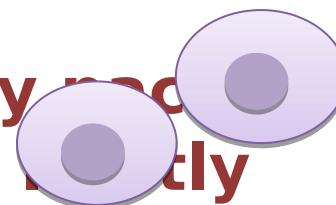
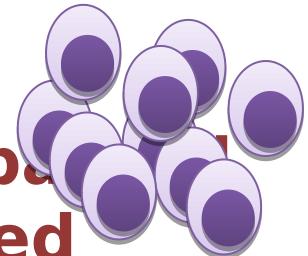
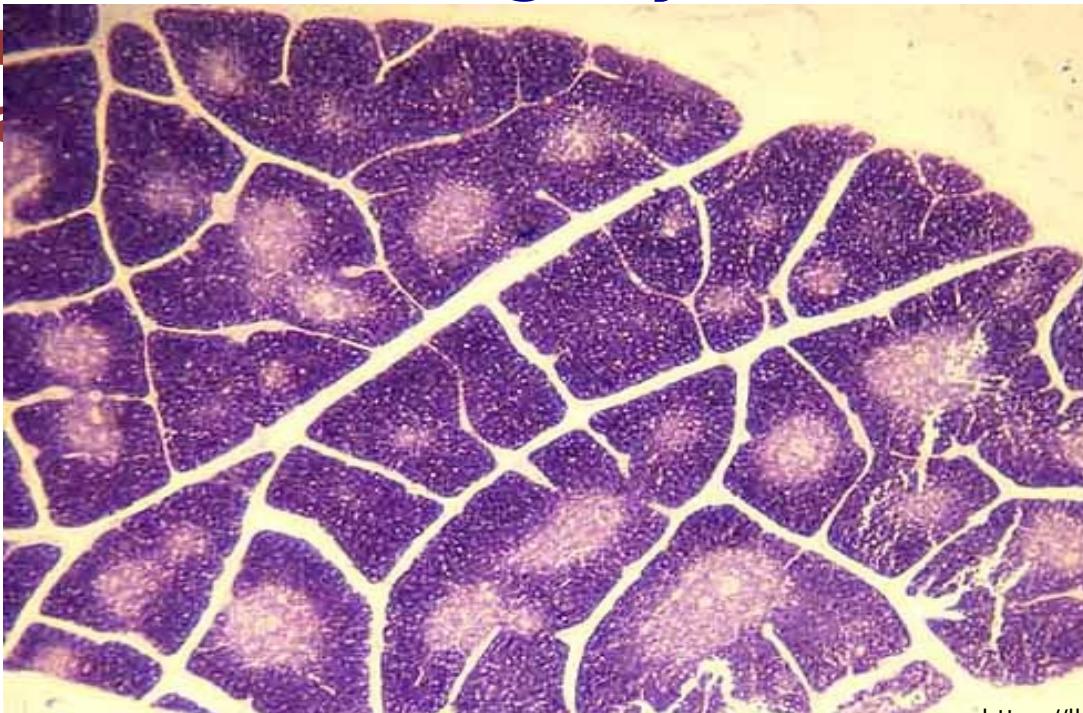


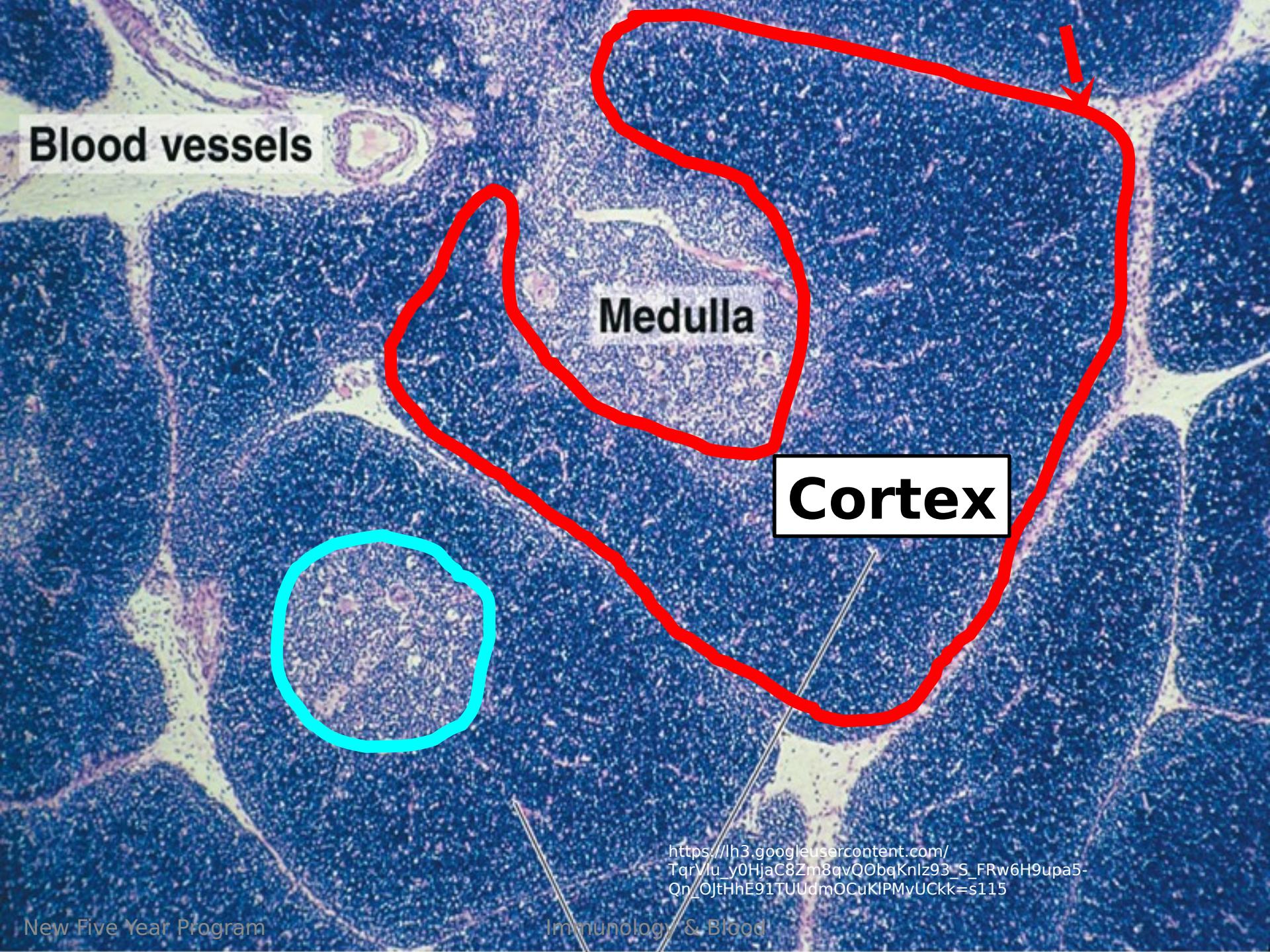
- Parenchyma

- Each lobule is formed of:

1. **Cortex** → darkly stained → closely packed small T lymphocytes with darkly stained nuclei.

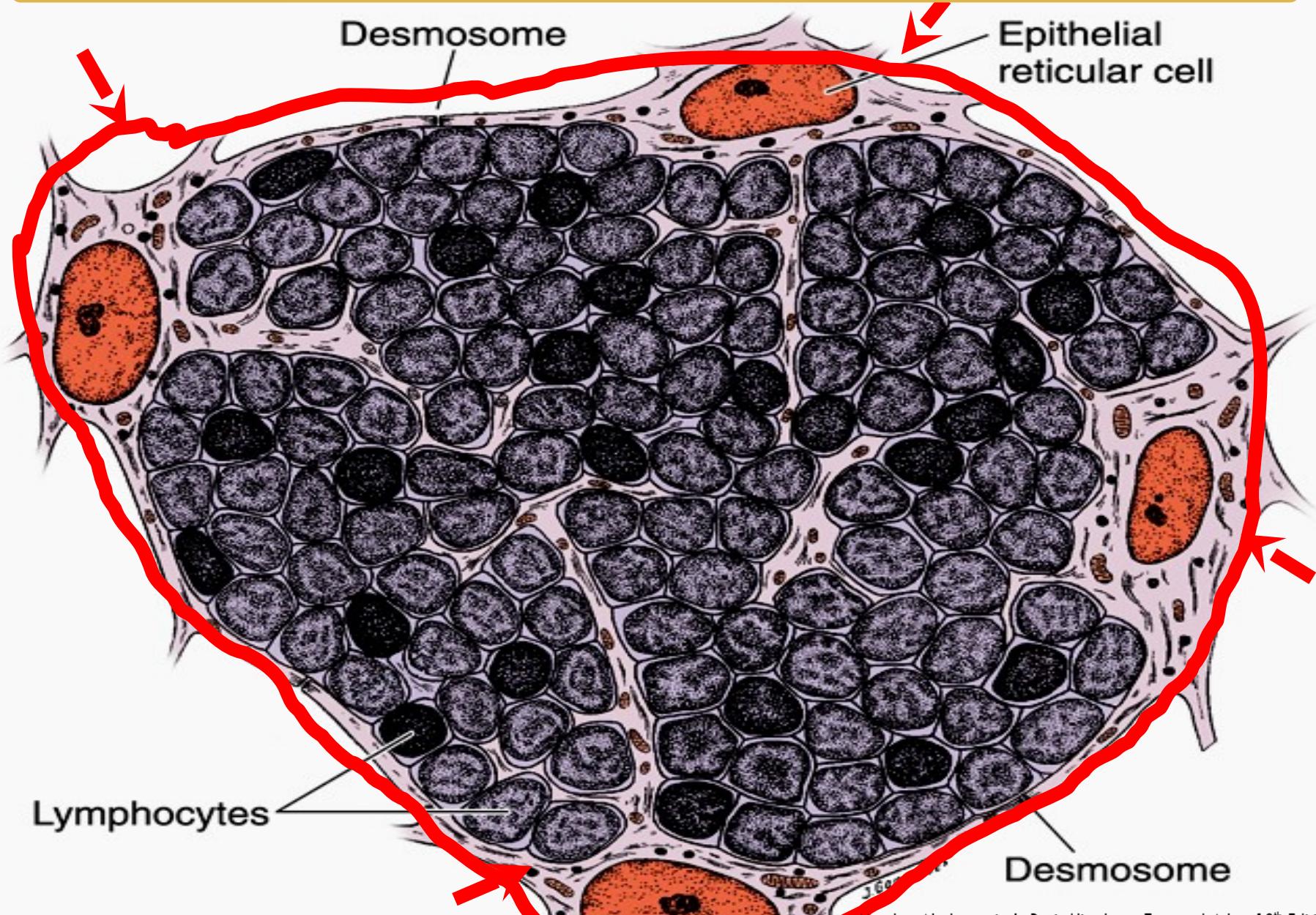
2. **Medulla** → lightly stained → loosely packed large T lymphocytes with lightly stained nuclei.



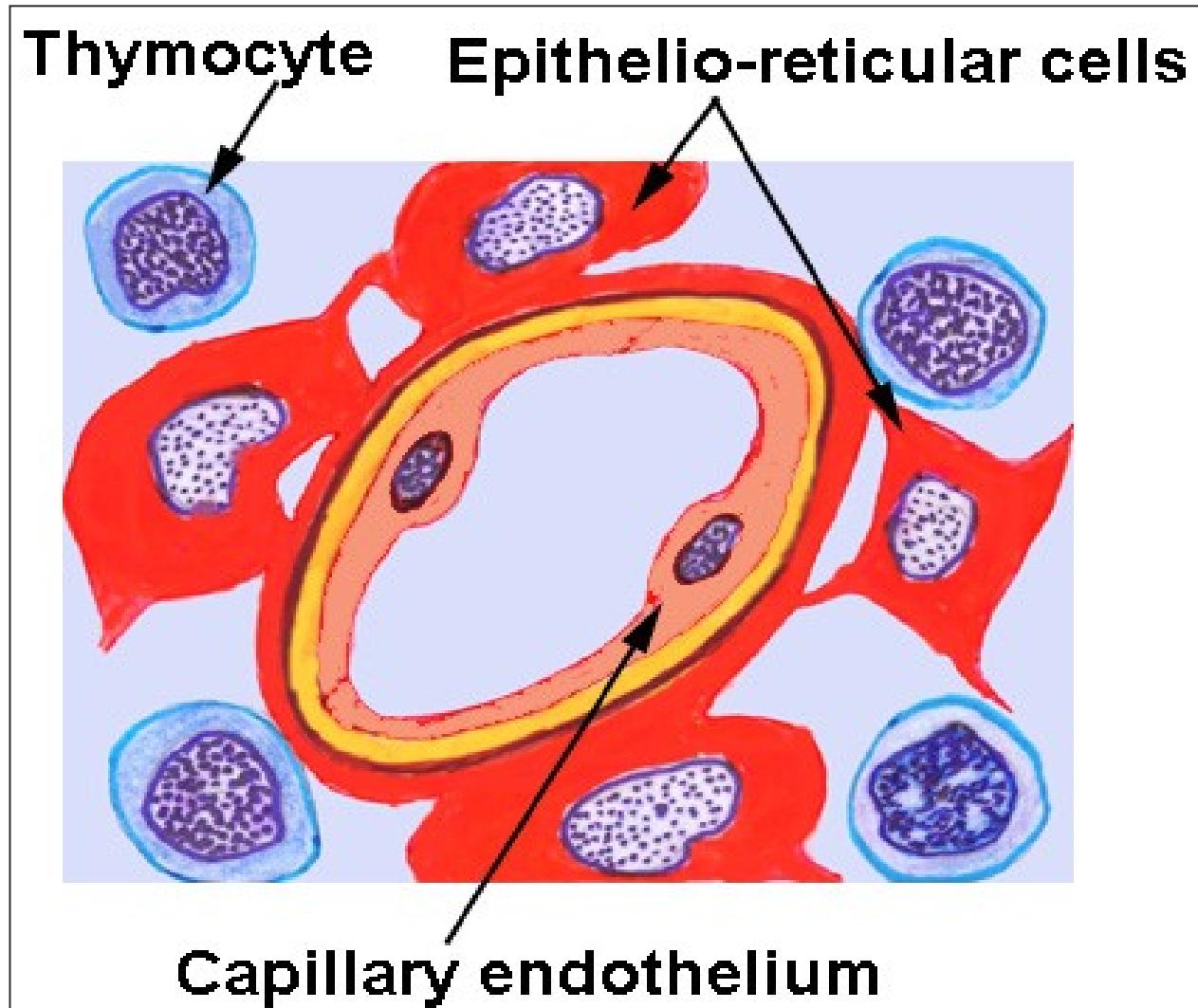


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# The Cortex of the Thymus



# Blood Thymus Barrier



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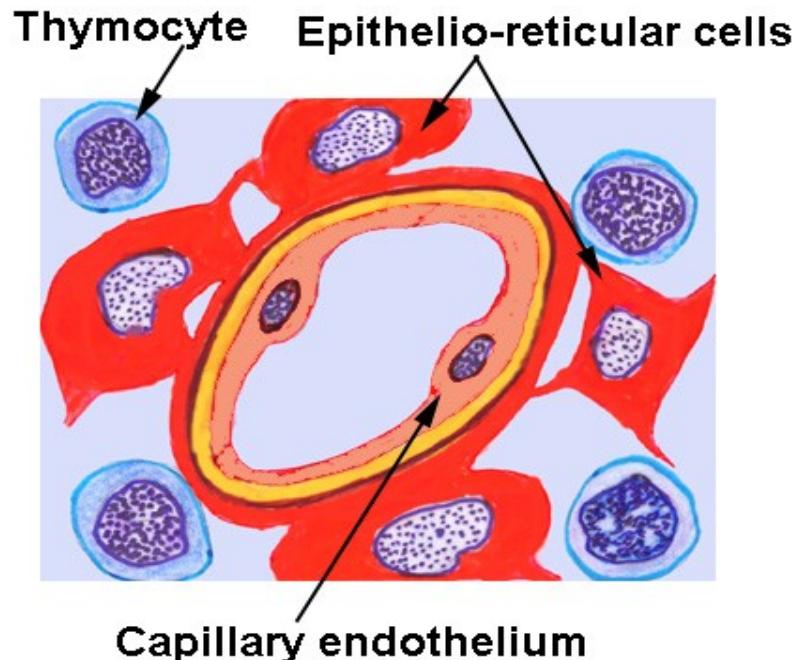
# Blood Thymus Barrier



- Present in the **cortex** making it an immunologically protected region.

- **Formed of:**

1. **Endothelium (continuous type)**
2. **Thick basement membrane**
3. **Perivascular C.T. with macrophages**
4. **Basement membrane of ERC**
5. **ERC Type I (epithelial)**



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**Function:** Prevents the contact between Ags in blood stream and developing T-cells in the thymic cortex.

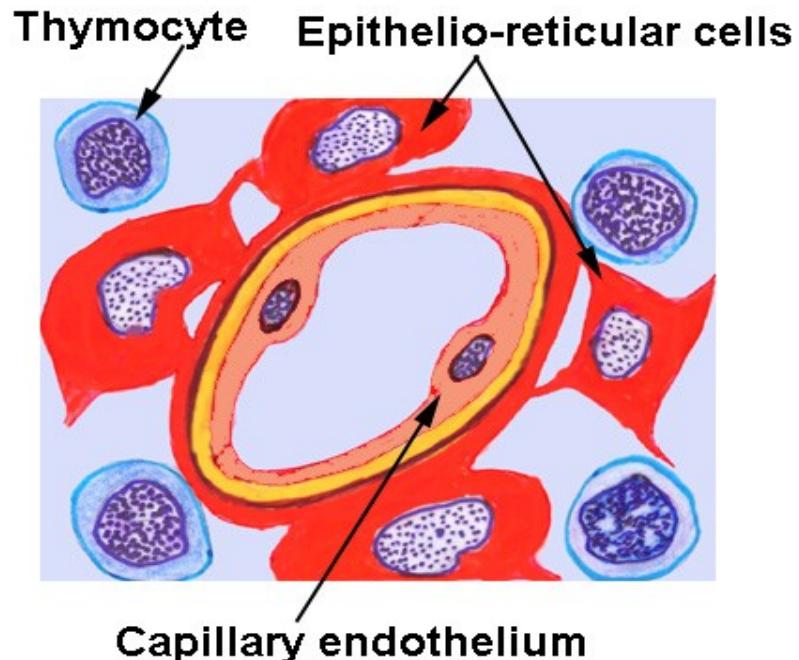
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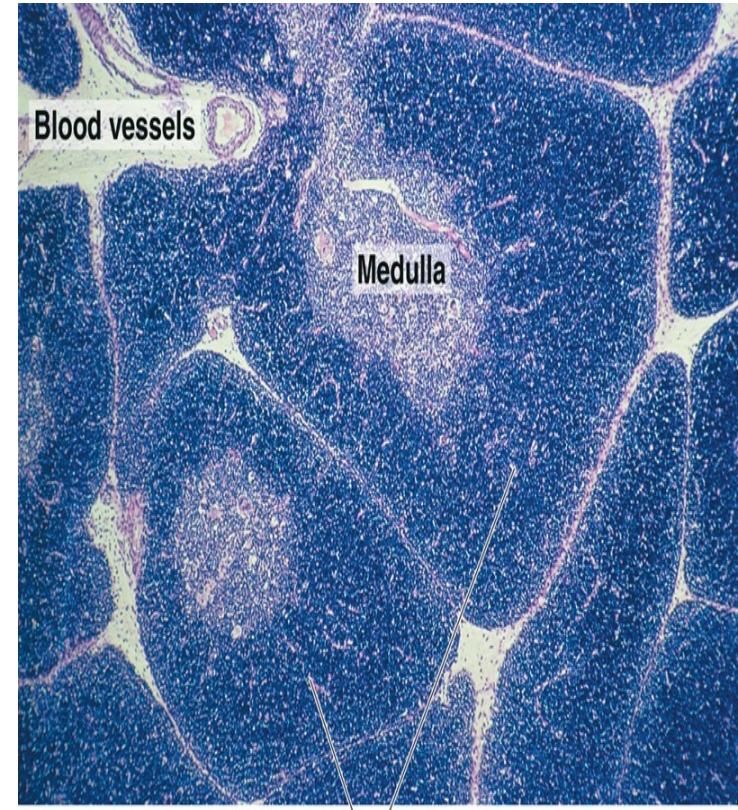
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**Function:** Prevents the contact between Ags in blood stream and developing T-cells in the thymic cortex.

# The Medulla of the Thymus

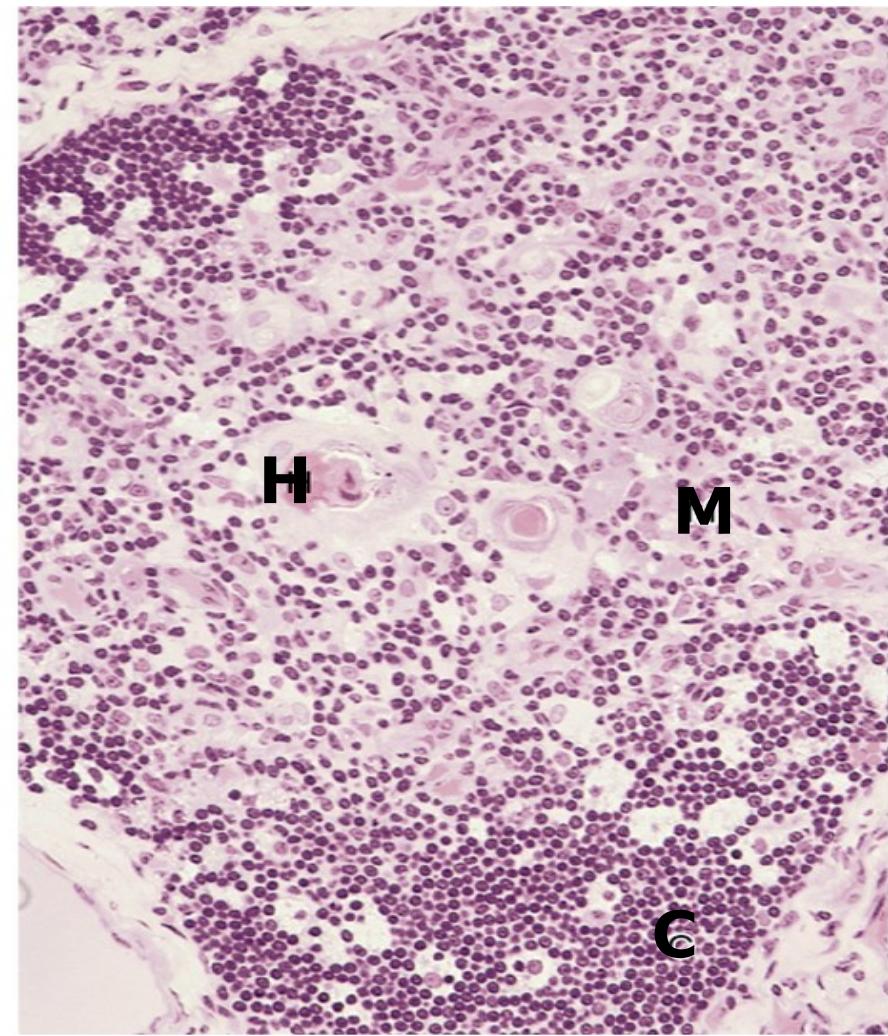
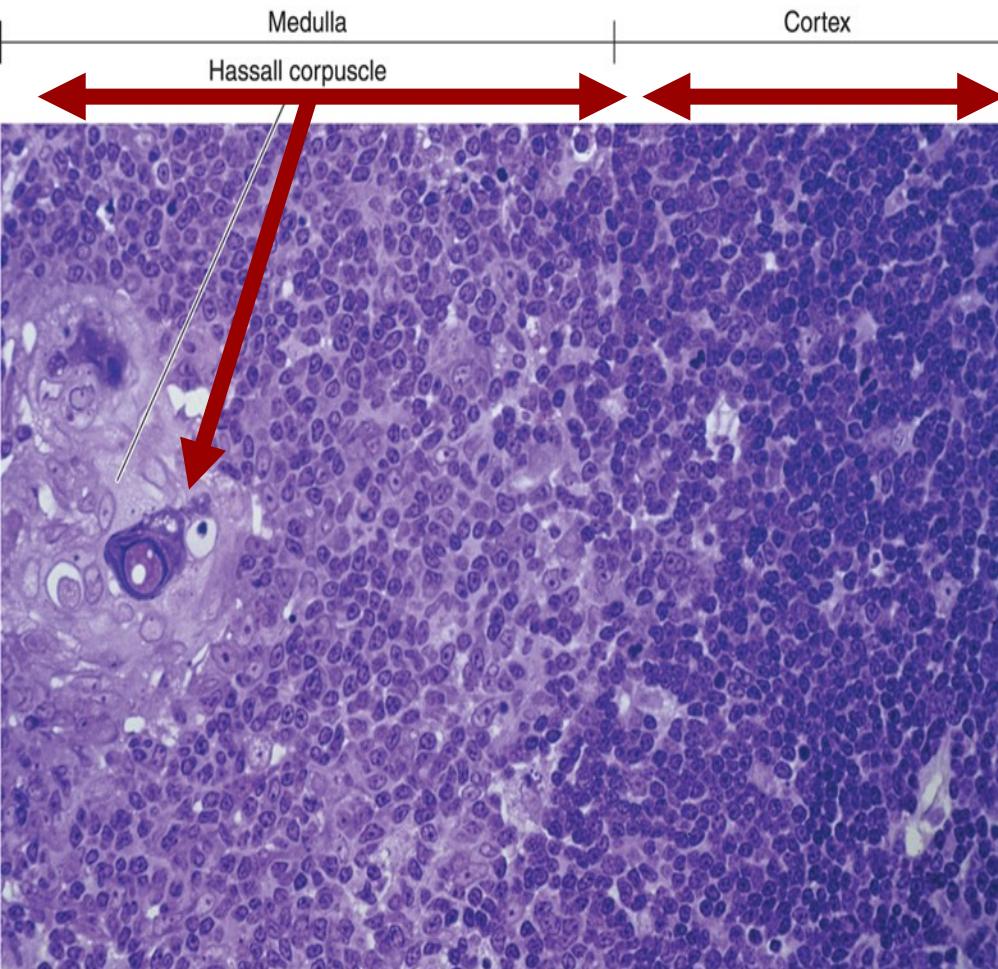


- **It is the central pale area of the thymus lobule.**
- **Contains:**
  - 1. Epithelial reticular cells (IV, V, VI) –**
  - 2. Mature T-lymphocytes**
  - 3. Hassal's Corpuscle**
  - 4. Macrophages**



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# The Medulla of the Thymus

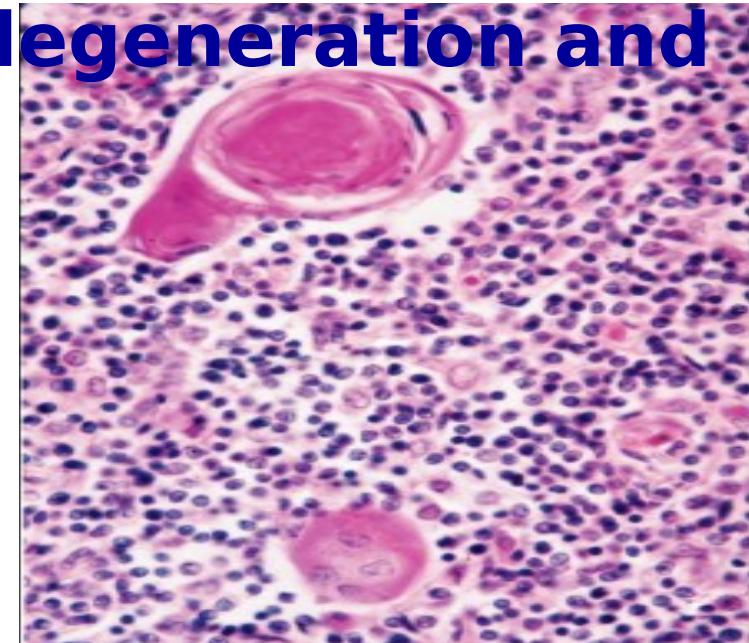


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# Hassal's Corpuscle

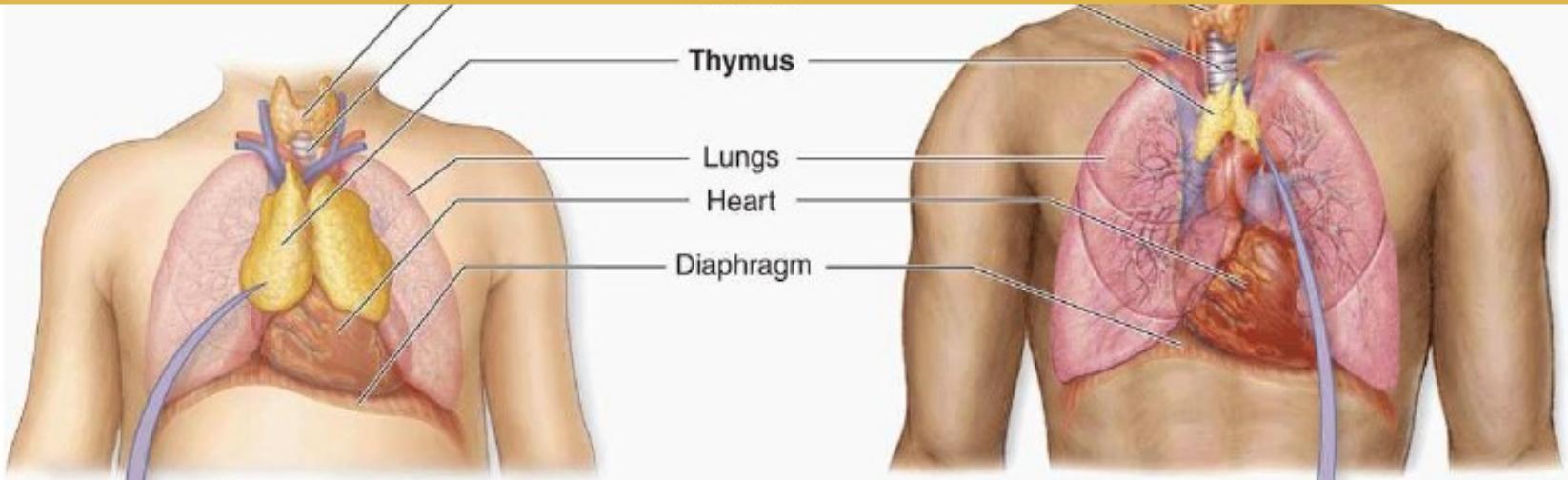


- **Formed of concentric layers of ERC around a central hyaline acidophilic mass in the medulla.**
- **Formed as a result of degeneration and calcification of ERC VI.**
- **They increase in number with age.**
- **Function:** their cells secrete several **cytokines** that promote development of T cells

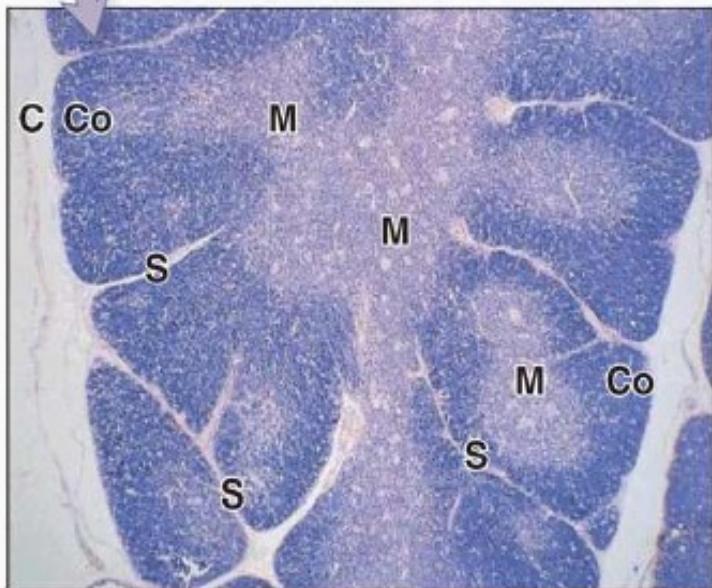


Ross MH, Pawlina W: Histology A Text & Atlas with correlated Cell & Molecular Biology, 6<sup>th</sup> Edition.

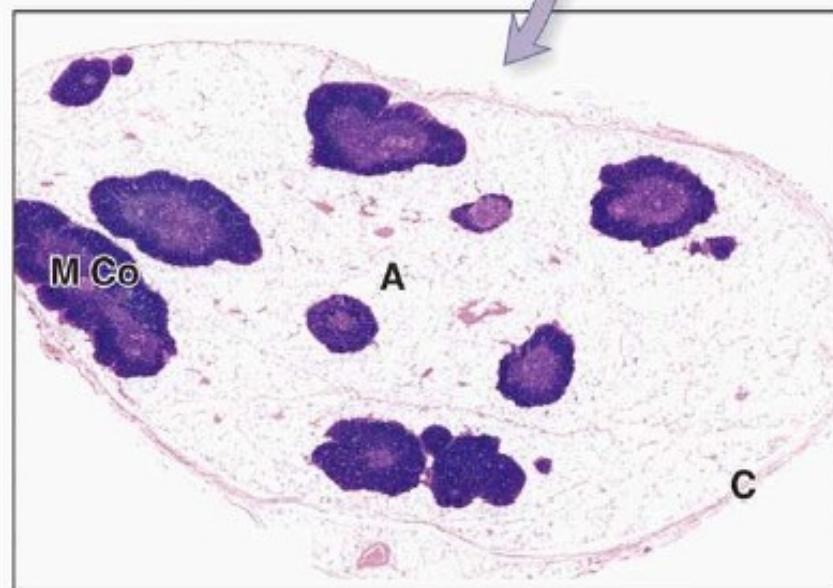
# Effect of Age on Thymus Size



a Child (left) and adult (right) thorax, anterior view

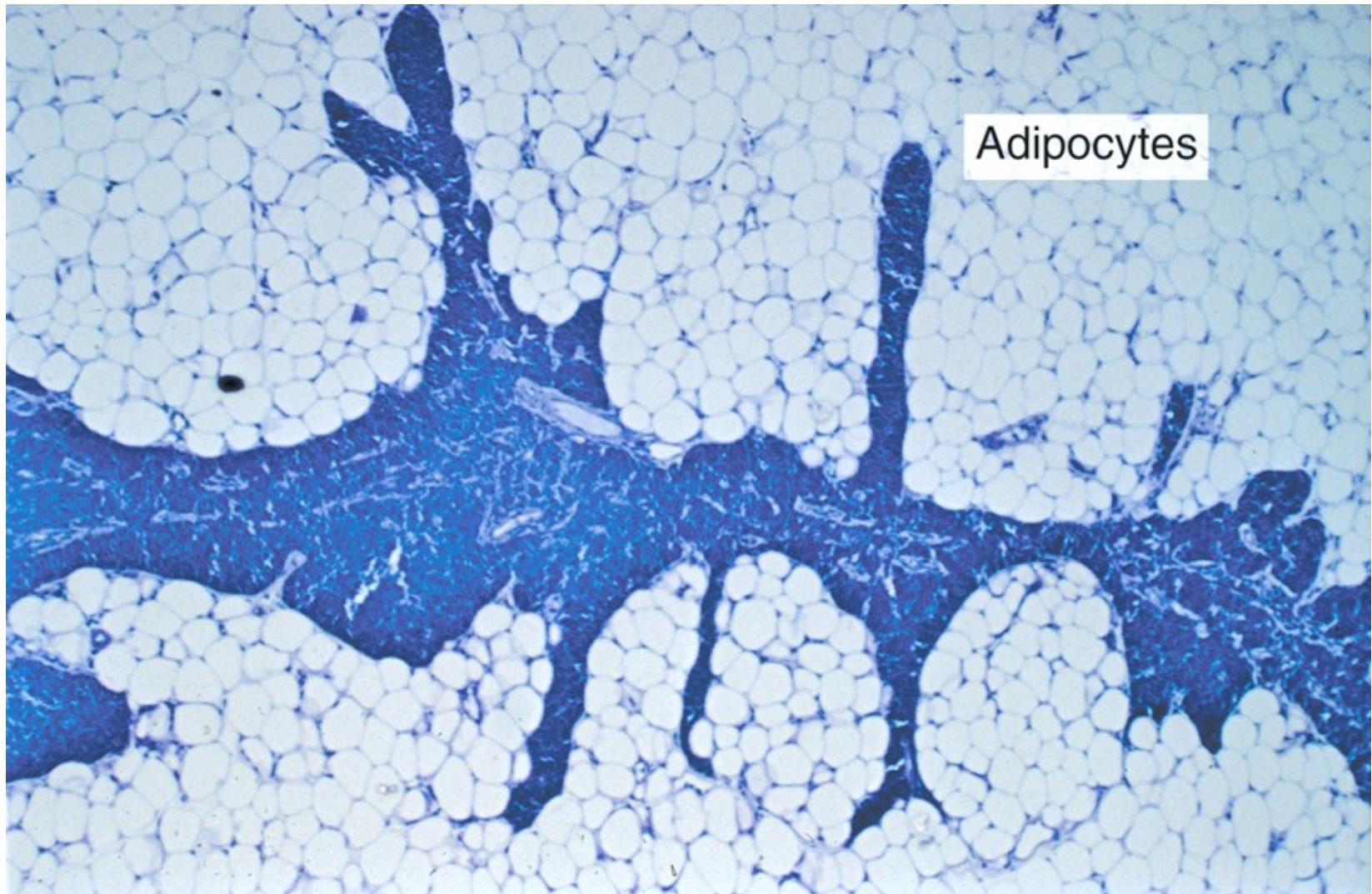


b Micrograph of child's thymus



c Micrograph of adult's thymus

# Thymus in Old Age



# Functions of the Thymus



- 1. Proliferation and differentiation of T-cells in the cortex immunocompetent blood stream thymus dependent zones.**
- 2. Thymic epithelial reticular cells secrete several hormones or factors which stimulate the differentiation of T-lymphocytes.**

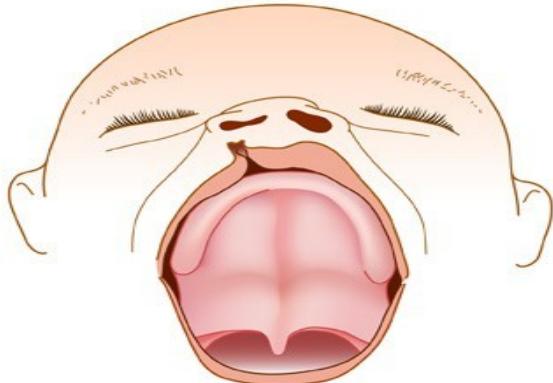
**How are the T lymphocytes protected during their differentiation in the cortex?...**

- 3. Blood thymic barrier**
- 4. Thymus has **NO** afferent lymphatics**



# Clinical Correlation

## DiGeorge Syndrome



**Thymic hypoplasia due to failure of development of 3<sup>rd</sup> & 4<sup>th</sup> pharyngeal pouches. It is a genetic disease.**

**Lack of all types of ERCs→ improper development of T lymphocytes →severe depression of cell-mediated immune response.  
(Decreased calcium level, cleft palate, cleft lip, heart defects)**

# Questions

# Question



- **The thymic cortex is characterized by all the following EXCEPT:**

- 1. It is the site of maturation of T lymphocytes.**
- 2. Its epithelial reticular cells secrete thymosin.**
- 3. It contains acidophilic Hassall's corpuscles.**
- 4. It is the outer dark region of the thymus.**

# Question



- **Which of the following is TRUE about the blood thymus barrier?**

- 1. It is present in the medulla of the thymus.**
- 2. It has a thin discontinuous basal lamina.**
- 3. The endothelium of blood capillaries is fenestrated.**
- 4. It is surrounded by complete layer of epithelial reticular cells.**

# Question

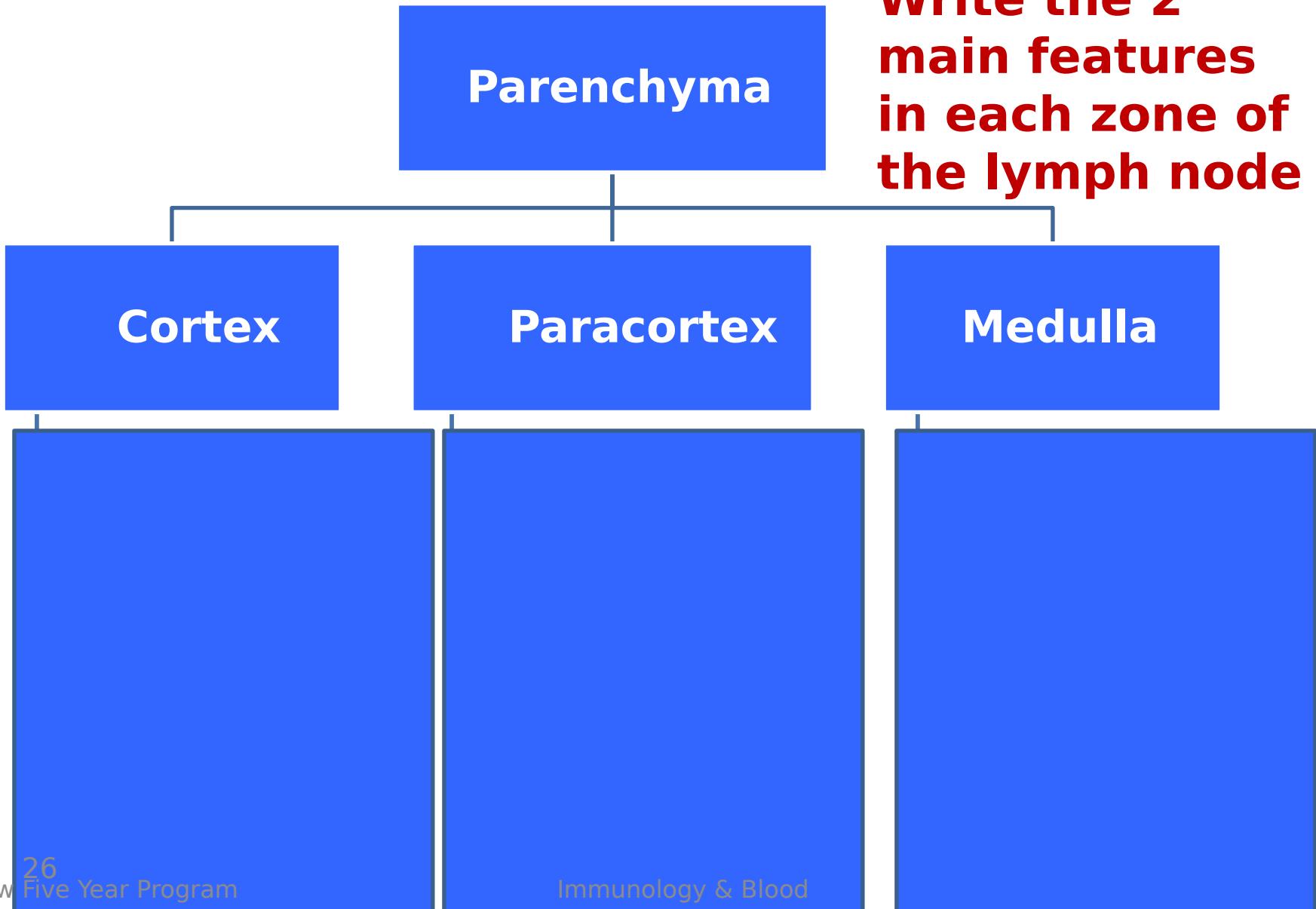


- **The medulla of the thymus contains:**
  1. B lymphoblasts
  2. ERCs type VI
  3. T lymphoblasts
  4. ERCs type I

# Lymph node



**Write the 2 main features in each zone of the lymph node**



# Question



• The splenic blood sinusoids are characterized by which of the following?

1. Are found in marginal zone.
2. Have continuous basal lamina.
3. Supported by collagen fibers type I.
4. Are lined by longitudinally arranged endothelial cells.

# Question



- **The periarterial lymphatic sheath is the site where:**

1. Phagocytosis of RBCs occurs
2. T lymphocytes are numerous
3. Lymphocytes leave the blood and enter the spleen
4. Filtration of lymph occurs

# Question



- **The periarterial lymphatic sheath is the site where:**
  - 1. Phagocytosis of RBCs occurs (red pulp)**
  - 2. T lymphocytes are numerous**
  - 3. Lymphocytes leave the blood and enter the spleen (marginal sinus)**
  - 4. Filtration of lymph occurs**

# Question



Most of T lymphocytes die in the-cortex by the ~~process~~ of **Apoptosis**

.....

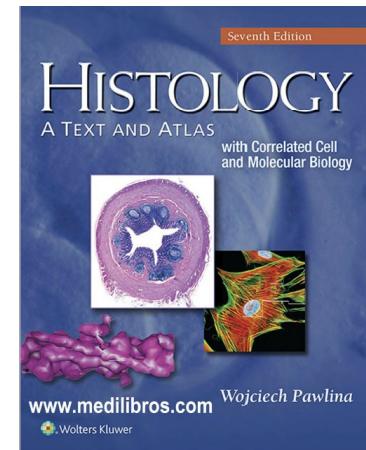
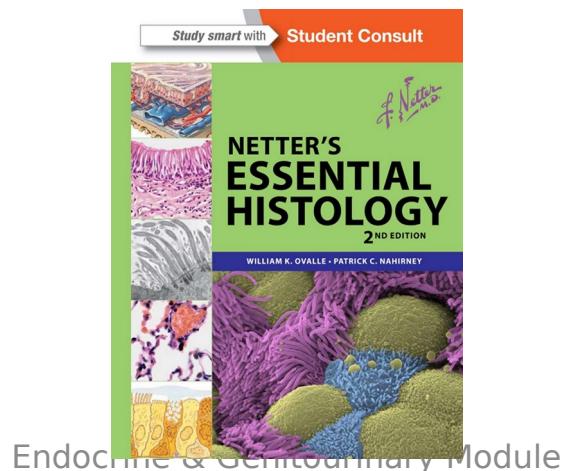
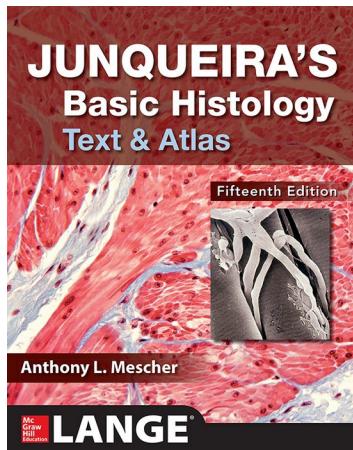
What are the components of the  
?blood

1. **Endothelium (continuous type)**
2. **Thick basement membrane**
3. **Perivascular C.T. with macrophages**
4. **Basement membrane of ERC**
5. **ERC Type I**

# SUGGESTED TEXTBOOKS



1. **Junqueira's Basic Histology: Text and Atlas, 16<sup>th</sup> Edition by Anthony Mescher, 2018.**
2. **Michael H. Ross & Wojciech Pawlina (2024), Histology Text and Atlas with correlated cell and Molecular Biology, 7<sup>th</sup> Edition.**





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